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AMSAT NEWS SERVICE
ANS-031

The AMSAT News Service bulletins are a free, weekly news and information service of AMSAT North America, The Radio Amateur Satellite Corporation. ANS publishes news related to Amateur Radio in Space including reports on the activities of a worldwide group of Amateur Radio operators who share an active interest in designing, building, launching and communicating through analog and digital Amateur Radio satellites.

The news feed on http://www.amsat.org publishes news of Amateur Radio in Space as soon as our volunteers can post it.

Please send any amateur satellite news or reports to:
ans-editor at amsat.org.

In this edition:

* Weekly engineering report for Phase 4 radio project from AMSAT
* Write About Satellites, Space and Radio!
* UFO Researcher To Launch CubeSat To Search For E.T. Close To Home
* Pair of Satellites ejected from ISS for In-Space Navigation Exercise
* LilacSat-2 FM Transponder
* 6W8CK on Satellite
* IARU Paper: APRS Harmonization and removal of OSCAR sub-band
* ISS Orbit Boosted Ahead of March Crew Swap - Check Your Elements
* ARISS News
* Satellite Shorts From All Over

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ANS-031 AMSAT News Service Weekly Bulletins

AMSAT News Service Bulletin 031.01
>From AMSAT HQ KENSINGTON, MD.
[MONTH DAY, YEAR]
To All RADIO AMATEURS
BID: $ANS-031.01

Weekly engineering report for Phase 4 radio project from AMSAT

The Phase 4 Ground weekly report focuses on the current modulation schemes. We're looking at DVB-S2X to receive, and OQPSK to transmit.

Repository for documents and software can be found:
https://github.com/phase4ground

We have nearly 50 volunteers on the mailing list and activity across the country. We're working hard to make a wonderful radio for AMSAT and terrestrial microwave, and we appreciate your support, feedback, comments, and critique.

DVB-S2 stands for Digital Video Broadcasting - Satellite - Second Generation. There is a recent extension to this standard, called DVB-S2X, that has very low SNR capabilities and a lot of other goodies. The geo project, ascent, and eventually the high earth orbit project,

are expected to transmit using DVB-S2X. This is the foundation of our common air interface.

DVB-S2X specifies the modulation and coding for our received signal. There are five major landmarks.
One, an input stream adapter. Input streams can be packetized or continuous, from single or multiple sources. This is helpful!

Two, forward error correction. Our type is low density parity check codes concatenated with BCH codes. What does this mean?

A concatenated code is one that combines two different coding schemes. In coding theory, there's a fundamental problem in that finding a really great code that has very low probability of error usually means that the block length has to go up, and the decoding is more and more complex. When you use two codes together that each have particular strengths, they balance each other out. You can get exponentially decreasing error probabilities, but you only have to pay a polynomially increasing cost in terms of code block length. This may seem complicated, but just remember concatenation is codes doing teamwork, and the standard that we're using is bad ass.
Our inner low density parity check code can achieve extremely low error rates near channel capacity. This means, it's about as good as you can get. The outer BCH codes are used to correct sporadic errors made by the LDPC decoder, and to trick it out so that we don't have enormous block lengths and stuff like that.

Three, we have a wide range of code rates. The code rate is expressed as a fraction. The top number is how many uncoded bits go in. The bottom number is how many coded bits come out. We have four constellations. This is the the type of transformation from bits to symbols. We have great choices here, and DVB-S2X provides additional choices.

Four, there is a variety of spectral shaping available to us in DVB-S2. This is a really neat thing. You can change the pulse shape of a transmitted waveform in order to make it better suited for the radio environment it's expecting to be traveling through. Usually this means making it fit into a bandwidth better. You don't get something for nothing, though, so being too aggressive with the pulse shaping shows up in other aspects. Our particular shaping is different levels of raised-cosign filtering. DVB-S2X provides additional levels of shaping.

Five, this standard lets us learn and develop with something very much like cognitive radio. As you can see, there are a lot of choices for coding and modulation. We can specify a fixed coding and modulation. This is called CCM for constant coding and modulation. In the past, people like us looked at a link, designed for the worst case solution, and used coding and modulation that would cover almost all the bases. DVB-S2 has CCM, but it also specifies something called variable coding and modulation, or VCM. The coding and modulation can be changed on a frame-by-frame basis in response to different station types or changes in the channel. In addition to that, there is something called adaptive coding and modulation, or ACM, where modulation and coding automagically adapts. This can happen on a frame by frame basis.

DVB-S2 has things called annexes. In annex M, there's a specification for something we've already talked about wanting to do. We want to map the transmitted services or station streams into time slices and then recover information without having to demodulate the entire signal.

DVB-S2 follows the usual flow of having input data coded up to remove unnecessary redundancy, which is called source coding, and then it is put into one of two different stream types. Because DVB-S2 is designed for MPEG streams, it has a lot of mechanisms for MPEG data types, and I believe that this is the transport stream path in the drawing. We aren't going to use MPEG, so we fall into the generic stream category.

The functional blocks of DVB-S2 include these things in trapezoids. Mode adaptation, which starts to build up the data frames by constructing the right header to go with the data. Stream adaptation, which adds in the right amount of padding and scrambling. Forward error correction, which produces coded frames that are of one of two sizes. Mapping to constellations, which is the modulation. Finally, there is physical layer framing. An open question is how minimal of a station can be supported? Driving it down as low as possible is going to be fun and challenging.

What we are anticipating is that the space teams will obtain an implementation of a DVB-S2X transmitter. Talks are already underway for this. Phase 4 ground is going to engineer the various DVB-S2X receivers. Standards documents are already in the repository and work is beginning. Get off the bench and hit the books!

So let's talk a bit about some changes in the uplink for phase 4 radios. We were MSK, or minimum shift keying, but we are now OQPSK, or offset quadrature phase shift keying. That is what the payload team is currently designing for.

Like MSK, Offset QPSK has no more than a 90 degree phase shift at a time. This is good. In order to create this, you begin with a QPSK signal, where you take two data bits at a time. These two binary data bits make four distinct values. Each of these values are mapped onto four transmit phase shifts.

For offset QPSK, the odd and even bits coming into the modulator have a timing offset, of one bit period. Hence the name. That means the in-phase and quadrature signals, the I and the Q, never change at the same time.

The power spectral density of QPSK and Offset QPSK is the same. The shift in time doesn't effect that.

Uplink experiments are beginning. We started putting together Team HackRF, which will investigate the use of HackRF SDRs as one of the phase 4 radio recipes. Lots of other experiments to work out other recipes for amateurs to experiment need to happen too. If you have a set of hardware and you want to work in parallel, then speak up. The USRPs will get into the act ASAP, some people have BladeRFs, and so on.

Review the weekly report at
https://www.youtube.com/watch?v=c0CMv0pJHgY&feature=share

[ANS thanks Michelle W5NYV for the above information]

Write About Satellites, Space and Radio!

The AMSAT Journal is seeking interesting articles about amateur radio satellites, space and radio – topics that feed the passion of

AMSAT members. Whether the focus is working the birds, new products, building a new piece of equipment or an entire station, writing software, training or doing demos, or anything else related to amateur radio in space, please consider sharing your experience and expertise with other AMSAT members by writing for the Journal.

Desired article length (rough guidelines):
  Short articles – 800-1400 words
  Longer articles – 2000-2500 words

Find out more about writer's guidelines here. Photos, diagrams or other images always help illustrate your points or projects.

If you are interested in seeing your byline in The AMSAT Journal and sharing what you've learned with other members, email us at journal(a)amsat.org.

[ANS thanks Joseph KB6IGK for the above information]

UFO Researcher To Launch CubeSat To Search For E.T. Close To Home

An engineer turned UFO researcher is hoping to launch a low-earth orbit CubeSat to search for evidence of extraterrestrial life. Canadian Dave Cote has assembled a seven-person team to design, fund, build and launch the project that he hopes will provide some answers about the origins of recent unidentified object sightings across the globe.

"We have had astronauts, military personnel, police officers and the former Defence Minister of Canada come forward stating that extraterrestrial UFOs are real, and that we are being visited," says Cote. "How can this be ignored and brushed off as nonsense?" Concerned that the public isn't getting straight answers, the group has turned to crowdsourcing the project on Kickstarter.

Measuring roughly the size of a shoebox, CubeSats can pack a lot of science equipment into a small space. They have also made satellite deployment much more affordable, in some cases costing less than the price of a lower-end automobile. Sites like CubeSatShop.com have taken much of the complexity out of ordering needed components.

Cote says they're a "go for launch" already but are looking for more funding so they can pack it with as much science equipment as possible. They aim to include image, infrared, electromagnetic, and radiation sensors. This would give them the capability of not only verifying visual data, but also correlating it with other events such as electromagnetic and radioactive fluctuations.

The team plans to measure ionized radiation with a scintillation counter and two cameras will capture a near 360-degree view around the CubeSat. They plan to remove the infrared filters on the cameras to cover more of the visual range.

Cote hopes to use amateur radio frequencies to transmit the data back to earth and a worldwide network of ham volunteers to receive it.

"We are planning to use the ham frequencies to send data down from the CubeSat to earth in hex or datafax protocol," says Cote. "From what we understand, we should be able to send a 100kB packet every few minutes and this will enable us to send image thumbnails from

space, along with some basic EM data."

While the details of the transmissions have yet to be determined, Cote hopes to assemble a worldwide team of hams willing to receive and log whatever data the satellite captures.

"We need help from the ham community, in capturing the data and relaying it to our site," he says. "There will be a 15-minute window for download from the CubeSat, and then another volunteer would be needed for the next 15-minute time window."

Cote is cautiously optimistic that the satellite will provide corroboration of UFO reports from eyewitnesses on Earth. But even if the satellite doesn't capture evidence of faraway visitors, he's hopeful that it will record interesting natural phenomenon like meteors and solar flares.

"We can only hope that those who would like to know the truth will step forward and help," he says.

To learn more about the project or to volunteer, visit their KickStarter page.
https://www.kickstarter.com/projects/1889966504/cubesat-for-disclosure

[ANS thanks Matt W1MST and AmateurRadio.com for the above information]

Pair of Satellites ejected from ISS for In-Space Navigation Exercise

A package of two satellites was ejected from the International Space Station on Friday to begin a mission dedicated to a demonstration of autonomous navigation, rendezvous and docking technology. The second LONESTAR mission is comprised of two satellites built by two American Universities to undertake a demonstration of communication cross links, data exchange, GPS-based navigation, relative navigation, stationkeeping and data transmission to the ground.

LONESTAR stands for "Low Earth Orbiting Navigation Experiment for Spacecraft Testing Autonomous Rendezvous and Docking" and includes four missions flown over a period of years in a cost-effective technology development program with the goal of mastering autonomous rendezvous and docking. The second LONESTAR mission consists of the AggieSat4 satellite built at Texas A&M and BEVO-2 built by students at the University of Texas. The smaller BEVO-2 satellite is facilitated within a deployer on the AggieSat4 spacecraft to be released once the two have flown well clear of the International Space Station.

The two satellites, already packaged, were sent to the Space Station aboard the Cygnus OA-4 mission. Launching satellites to ISS for deployment has the advantage of allowing the satellites to be launched well-packaged to avoid damage and providing the opportunity of an inspection in space to check for any damage encountered during launch before committing them to flight.

Given the size of the AggieSat4 satellite, the deployment conducted on Friday made use of the SSIKLOPS deployment mechanism, going by the full name "Space Station Integrated Kinetic Launcher for Orbital Payload Systems." SSIKLOPS can be used to deploy larger satellites of different shapes up to a mass of 110 Kilograms. It is a flat structure that includes grapple fixtures for the robotic arms of the

Space Station and a single grapple fixture for the satellite that is to be deployed. The fixture includes clamps and springs for the deployment of the satellite. Overall, the structure is 127 by 61 by 7.6 centimeters in size. It also includes interfaces for the slide table of the JEM Airlock.

SSIKLOPS first saw action in 2014 when deploying the SpinSat spacecraft and spent most of its time in storage aboard ISS, awaiting the deployment of future satellites. Final preparations for Friday's deployment were made on Wednesday when ISS Astronauts Scott Kelly and Tim Peake installed the SSIKLOPS deployer on the Slide Table of the Kibo module's airlock followed by the installation of the Small Fine Arm (SFA) Plate on the deployer and the attachment of the LONESTAR satellite package. The slide table was then retracted and the airlock sealed off for depressurization on Thursday.

The outer hatch of the airlock was opened and a careful ground-controlled operation started to retrieve the SSIKLOPS deployer and hand it from the Small Fine Arm to the Japanese Robotic Arm that was then positioned for the deployment to ensure the satellite departed to the correct direction, ruling out any possibility of re-contact with ISS on subsequent orbits. Release was triggered just before 16:00 UTC on Friday and the LONESTAR package slowly floated away from ISS, embarking on its mission that will last as long as the satellites can remain in orbit, typically between six and twelve months.

Drifting away from the Space Station, LONESTAR showed slight body rates on all three axes as it slowly faded into the distance. The Mission Team confirmed they were happy with the observed body rates and declared the deployment a success. Congratulations were exchanged between the different teams involved in the deployment - NASA's Mission Control, the JAXA Control Center in Japan, Payload Controllers in Huntsville and the payload's operators in Texas.

The spacecraft was programmed to power-up automatically ten minutes after release, perform a health check and start transmitting telemetry. Acquisition of signal was expected later on Friday to begin a multi-day checkout campaign ahead of the satellite conducting its de-tumble maneuver to enter a three-axis stabilized attitude setting up for the deployment of BEVO-2.

The AggieSat4 satellite, developed and manufactured at Texas A&M University, has a mass of approximately 55 Kilograms and measures 75 x 75 x 35 centimeters in size. The satellite hosts body-mounted solar panels for power generation and is equipped with a three-axis attitude determination and control system with an actuation accuracy of two degrees, making use of reaction wheels and magnetic torquers. The Electrical Power System hosts two battery packs delivering an operational voltage of 34 V and a capacity of 95 Watt-hours.

AggieSat4 hosts two low-data-rate (LDR) radios, a high-data-rate (HDR) radio, a crosslink radio for short-range communication with the Bevo-2 satellite, and a DRAGON GPS Payload.

AggieSat4 will be tasked with completing a number of mission objectives: demonstrating three-axis stabilization, the collection of GPS data, recording video of the release of BEVO-2 with a 2MP camera, computing and crosslinking relative navigation data based on relative GPS measurements and tracking BEVO-2 based on these navigation solutions.

The 4.2-Kilogram BEVO-2 satellite uses the 3U CubeSat Form Factor, 10 x 10 x 34 centimeters, employing an ISIPOD for deployment from

AggieSat4. The satellite features 24 solar cells installed on its external panels to deliver power to 6 batteries operating at a voltage of 7.4 V.

BEVO-2 has four deployable radio antennas and GPS patch antennas. Attitude determination is accomplished with gyroscopes, magnetometers, a star tracker and sun sensor while attitude actuation employs reaction wheels and magnetic torquers. To connect with AggieSat4 for the exchange of navigation data, the spacecraft hosts a crosslink radio unit while communications with the ground make use of a UHF/VHF terminal for data downlink and command uplink.

The satellite is outfitted with a cold gas thruster module holding 90 grams of Dupont R-236fa refrigerant stored at pressure to be released for maneuvers of the satellite for stationkeeping and rendezvous exercises with AggieSat4.

As the second of four LONESTAR missions, AggieSat4 and BEVO-2 build on the success of the previous mission in 2009 as part of a program outlined to make successive progress towards the ultimate goal of achieving an autonomous rendezvous and docking of two satellites. The autonomy aspect of LONESTAR is of particular importance for future missions to distant targets where communication delays require spacecraft to act autonomously.

[ANS thanks spaceflight101.com for the above information]

LilacSat-2 FM Transponder

Paul Stoetzer reports:
"I have noticed that LilacSat-2's FM transponder has been on nearly continuously for the past four days They may be keeping it active continuously during the holiday period in China.

It's worth checking out if you haven't worked it yet. It's got a good signal and can be easier to track than SO-50 because the carrier stays active for a period when not receiving signals. The downlink antenna also uses circular polarization, so there is less fading when using linear antennas than on SO-50.

Uplink: 144.350 MHz FM (No PL)
Downlink: 437.200 MHz FM

Keep in mind that this uplink frequency is not within the normal 145.800 - 146.000 MHz satellite subband on two meters, though this frequency is within the 144.300 - 144.500 MHz "New OSCAR subband" in the ARRL band plan and is allocated to the Amateur Satellite Service (as is the entirety of 144 - 146 MHz). On passes over the United States, quite a few packet signals can be heard through the transponder.

If you use LoTW, the satellite name to use when uploading QSOs is 'CAS-3H.'

[ANS thanks Paul N8HM for the above information]

6W8CK on Satellite

Conrad, 6W8CK, will be active on satellites from IK14 near Mbour, Senegal until mid-February. He does not wish to publish his private email, but is interested in skeds with North American stations who are in range. If you are interested in setting up a sked, please look up your mutual windows and email me. I will contact Conrad with a list of operators and mutual windows.

He will try to be active on CW near 145.930 on AO-7 and 435.830 on FO-29 during the afternoons, but may also be available on late night / early morning passes for skeds.

Conrad is using a Yaesu FT-736R and an Elk antenna mounted up 5 meter above ground. He does occasionally lose power, so keep this in mind if you do not hear him on a particular pass.

QSL only via the DARC bureau to his home call, DF7OL. He may also return to Senegal from November 2016 - February 2017.

[ANS thanks Paul, N8HM for the above information]

IARU Paper: APRS Harmonization and removal of OSCAR sub-band

IARU Region 1 has released the papers for the Interim Meeting to be held in Vienna April 15-17, 2016.

Among the papers for the C5 VHF/UHF/Microwave Committee is one on harmonizing APRS.

VIE16_C5_41_1.pdf – 144 /435 MHz APRS Harmonisation

The paper covers global band planning considerations and among the recommendations says:

Emphasise that spaceborne APRS must be confined to globally coordinated amateur satellite sub bands. Therefore items that are ambiguous and generate confusion in national band plans such as ‘Space communications’ and ‘New Oscar Sub band’ should be removed as soon as possible in all Regions in accordance with IARU-AC and Satellite Coordination guidance

It is believed that ‘New Oscar Sub band’ refers to the USA’s ARRL 144 MHz band plan and ‘Space communications’ to the Australian WIA 144 MHz band plan. These band plans, as well as those for some other countries, show 144.300 – 144.500 MHz as being for Amateur Satellite use.

Direct link for C5 VHF/UHF/Microwave Papers
http://tinyurl.com/ANS031-Microwave

Links for all committee papers and email addresses of Committee Chairs are at
http://tinyurl.com/ANS031-IARU

ARRL 144 MHz Band Plan http://www.arrl.org/band-plan

WIA 144 MHz Band Plan http://tinyurl.com/ANS031-APRS

[ANS thanks AMSAT-UK for the above information]

ISS Orbit Boosted Ahead of March Crew Swap - Check Your Elements

The International Space Station raised its orbit Wednesday afternoon before a pair of crews swap places and a cargo ship arrives in March. One-year crew members Scott Kelly of NASA and Mikhail Kornienko of Roscosmos are set to return home March 1 along with Russian cosmonaut Sergey Volkov. Then, Expedition 47 will begin and three new crew members will arrive March 19. New supplies are scheduled to be delivered to the crew March 31 aboard a Progress 63 cargo craft.

The orbiting Expedition 46 crew was back at work Tuesday on a series of life science and physics experiments to benefit life on Earth and crews living in space. Commander Scott Kelly explored maximizing the effects of exercise in space while British astronaut Tim Peake studied how living in space affects using touch-based technologies, repairing sensitive equipment and a variety of other tasks. NASA astronaut Tim Kopra researched how materials burn in space.

Two cosmonauts resized their Russian Orlan spacesuits today, checked them for leaks and set up hardware before next week’s maintenance spacewalk. Flight Engineers Sergey Volkov and Yuri Malenchenko will work outside Feb. 3 in their Orlan suits to install hardware and science experiments on the orbital lab’s Russian segment.

[ANS thanks blogs.nasa,gov for the above information]

ARISS News

+ A Successful contact was made between Brihaspati Vidyasadan, Kathmandu, Nepal and Astronaut Timothy Peake KG5BVI using Callsign NA1SS. The contact began 2016-01-20 08:37 UTC and lasted about nine and a half minutes. Contact was telebridge via VK5ZAI. ARISS Mentor was 7M3TJZ. This event represents the 984th ARISS contact. A YouTube video of the evnt can be seen here https://www.youtube.com/watch?v=25gCS1JTPxA

Upcoming ARISS Contact Schedule as of 2016-01-27

Christ The King School, Rutland, Vermont, telebridge via VK4KHZ) The ISS callsign is presently scheduled to be NA1SS. The scheduled astronaut is Tim Kopra KE5UDN
Contact is a go for: Thu 2016-02-04 18:28:16 UTC

"Gesmundo Moro Fiore" Secondary School, Terlizzi, Italy, telebridge via LU1CGB. The ISS callsign is presently scheduled to be NA1SS. The scheduled astronaut is Timothy Peake KG5BVI.
Contact is a go for: Sat 2016-02-06 09:09:01 UTC

[ANS thanks ARISS, Charlie AJ9N and David AA4KN for the above information]

Satellite Shorts From All Over

+ Congrats to Steve Kristoff, AI9IN, for having worked 5 hams in the EM55 grid.
  To earn 5 in EM55 award #59, please check out
  http://www.starcommgroup.org for the awards offered.

  [ANS thanks Damon Runion, WA4HFN, for the above information]

+ The Colorado Amateur Satellite Net is held 7PM mountain time on Thursdays 6PM Pacific. 7PM Mountain, 8PM Central, 9PM Eastern

  For more information visit http://www.amsatnet.info/

  [ANS thanks Skyler KD0WHB for the above information]

+ The Jan/Feb issue of The AMSAT Journal is off to the printer.

  [ANS thanks Joseph KB6IGK for the above information]

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In addition to regular membership, AMSAT offers membership in the President's Club. Members of the President's Club, as sustaining donors to AMSAT Project Funds, will be eligible to receive additional benefits. Application forms are available from the AMSAT Office.

Primary and secondary school students are eligible for membership at one-half the standard yearly rate. Post-secondary school students enrolled in at least half time status shall be eligible for the student rate for a maximum of 6 post-secondary years in this status. Contact Martha at the AMSAT Office for additional student membership information.

73,
This week's ANS Editor,
EMike McCardel, AA8EM (former KC8YLD)
kc8yld at amsat dot org